

Poster-Tu31

Effect of carrier heating induced by current bias in the regime of Shubnikov de Haas oscillations in the high mobility GaAs/AlGaAs 2D electron systems

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The ultra-high mobility GaAs/AlGaAs 2D electron system has served as the host for many new physical phenomena in condensed matter physics. Recent investigations of steady state non-equilibrium phenomena have produced new interest in the magnitude and role of electron heating induced by photo-excitation or current bias. Hence, we trace the joule heating effect through a study the background subtracted diagonal resistance (ΔR_{xx}) in the GaAs/AlGaAs 2D electron system in the regime of Shubnikov-de Haas (SdH) oscillations to determine the influence of a relatively low ac bias on the carrier temperature. The change in the amplitudes of SdH oscillations with the ac bias at different bath temperatures ($0.2\text{ K} \leq T_b \leq 4.2\text{ K}$) was analyzed to extract the elevated electron temperature.[1] GaAs/AlGaAs Hall bar devices including segments with different widths were measured to determine the size dependence of the current bias induced electron heating. Results indicate that a steady state non-equilibrium hot electron situation can be induced by an ac bias current and increased electron temperature is linearly proportional to the ac current, and it is size dependent. These factors can be accounted using a model where the electron-electron scattering is the dominant pathway for energy relaxation, with a secondary role for energy relaxation by electron-phonon coupling.[2]

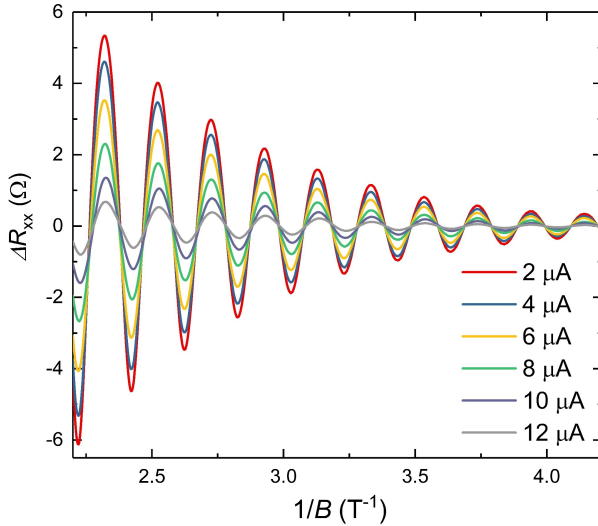


FIG. 1. The figure shows the background subtracted diagonal resistance versus the inverse magnetic field at different bias currents in a GaAs/AlGaAs 2D device.

[1] A. N. Ramanayaka, R. G. Mani, and W. Wegscheider, Phys. Rev. B **83** 165303 (2011)

[2] X. L. Lei, and S. Y. Liu, Phys. Rev. B **72** 075345 (2005)

Tuesday Posters



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Home

Information

Venue
Important Dates
Committees
Sponsors

Programme

Invited Speakers
Scientific Programme
Information for posters
Social Programme

Registration

Abstract Submission
Accommodation

Scientific Programme

[Programme Summary](#)

[Programme](#)

[Programme and abstracts invited talks](#)

[Abstracts contributed talks](#)

[Abstracts Monday poster session](#)

[Abstracts Tuesday poster session](#)

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